Claims

What is claimed is:

1. A distributed Bragg reflector exhibiting high reflectivity for photons of a predetermined energy E and a predetermined propagation axis, said reflector comprising a stacked plurality of repeat units, each repeat unit comprising a high-index layer, a first interlayer atop said high-index layer, a low-index layer atop said first interlayer, and a second interlayer atop said low-index layer, wherein:

   a) said high-index layer is composed essentially of a first material which is characterized by a first index of refraction, a first conduction band energy E_c^1, a first valence band energy E_v^1 and a first electronic bandgap E_b^1 , said first electronic bandgap E_b^1 being greater than the predetermined energy E;

   b) said low-index layer is composed essentially of a second material which is characterized by a second index of refraction which is smaller than said first index of refraction, a second conduction band energy E_c^2 , a second valence band energy E_v^2 and a second electronic bandgap E_b^2 , said second electronic bandgap E_b^2 being greater than the predetermined energy E;

   c) said first interlayer has a thickness along said predetermined propagation axis not greater than about 10 nanometers, and is composed essentially of a first interlayer material which is characterized by a first interlayer conduction band energy E_c^{IL1} and a first interlayer valence band energy E_v^{IL1}, the energies $E_c^{IL1}-E_v^{IL1}$; $E_c^{IL1} - E_v^1$; $E_c^1 - E_v^{IL1}$; $E_c^{IL1} - E_v^2$; $E_c^2 - E_v^{IL1}$ all being greater than said predetermined energy E;

   d) said second interlayer has a thickness along said predetermined propagation axis not greater than about 10 nanometers, and is composed essentially of a second interlayer material which is characterized by a second interlayer conduction band energy E_c^{IL2} and a second interlayer valence band energy E_v^{IL2}, the energies $E_c^{IL2}-E_v^{IL2}$; $E_c^{IL2} - E_v^1$; $E_c^1 - E_v^{IL2}$; $E_c^{IL2} - E_v^2$; and $E_c^2 - E_v^{IL2}$ all being greater than said predetermined energy E;

and further wherein the combined optical thickness along said propagation axis of each repeat unit is nominally equal to one-half of the wavelength of said photons of a predetermined energy.

2. The distributed Bragg reflector of claim 1, wherein the first interlayer material and the second interlayer material are substantially identical.

3. The distributed Bragg reflector of Claim 1 wherein the high-index layer consists essentially of aluminum gallium arsenide antimonide (AlGaAsSb), the low-index layer consists essentially of indium phosphide (InP), and the first and second interlayers consist essentially of aluminum arsenide antimonide (AlAsSb).

4. The distributed Bragg reflector of Claim 3 wherein the AlGaAsSb consists essentially of $Al_{0.1}Ga_{0.9}As_{0.52}Sb_{0.48}$.

5. The distributed Bragg reflector of Claim 3 wherein a semiconductor alloy composition of the AlAsSb in the first and second interlayers is substantially identical.

6. The distributed Bragg reflector of Claim 5 wherein the AlAsSb in the first and second interlayers consists essentially of $AlAs_{0.56}Sb_{0.44}$.

7. The distributed Bragg reflector of Claim 1 wherein the high-index layer consists essentially of aluminum gallium arsenide antimonide (AlGaAsSb), the low-index layer consists essentially of indium phosphide (InP), and the first and second interlayers each consist essentially of aluminum gallium arsenide antimonide (AlGaAsSb), with an aluminum content in the first and second interlayers being higher than the aluminum content of the AlGaAsSb low-index layer.

8. The distributed Bragg reflector of Claim 7 wherein the high-index layer consists essentially of $Al_{0.1}Ga_{0.9}As_{0.52}Sb_{0.48}$.

9. The distributed Bragg reflector of Claim 7 wherein a semiconductor alloy composition of the AlGaAsSb in the first and second interlayers is substantially identical.

10. The distributed Bragg reflector of Claim 7 wherein the AlGaAsSb in the first and second interlayers consists essentially of $Al_xGa_{1-x}As_{1-y}Sb_y$ with $0.89 < x < 1.0$ and with $0.44 < y < 0.445$.

11. The distributed Bragg reflector of Claim 1 wherein the plurality of repeat units comprises at least six repeat units and less than or equal to fifty repeat units.

12. A distributed Bragg reflector for use at a wavelength near 1.55 μm, comprising a stacked plurality of repeat units with each repeat unit having an optical thickness substantially equal to one-half of the wavelength near 1.55 μm, and with each repeat unit comprising a high-index layer consisting essentially of aluminum gallium arsenide antimonide (AlGaAsSb); a first interlayer adjacent the high-index layer; a low-index layer consisting essentially of indium phosphide (InP) adjacent the first interlayer; and a second interlayer adjacent the low-index layer, and with the first and second interlayers each having an energy bandgap greater than 0.82 eV and each acting to substantially prevent optical absorption in the distributed Bragg reflector from spatially indirect photon-assisted transitions between the high-index and low-index layers therein.

13. The distributed Bragg reflector of Claim 12 wherein the first and second interlayers each have a layer thickness of less than or equal to 10 nanometers.

14. The distributed Bragg reflector of Claim 12 wherein the first and second interlayers each consist essentially of AlAsSb.

15. The distributed Bragg reflector of Claim 14 wherein a semiconductor alloy composition of the AlAsSb in the first and second interlayers is substantially identical.

16. The distributed Bragg reflector of Claim 15 wherein the semiconductor alloy composition of the AlAsSb in the first and second interlayers is $AlAs_{0.56}Sb_{0.44}$.

17. The distributed Bragg reflector of Claim 12 wherein the first and second interlayers each consist essentially of AlGaAsSb with an aluminum composition higher than the aluminum composition of each AlGaAsSb high-index layer.

18. The distributed Bragg reflector of Claim 17 wherein a semiconductor alloy composition of the AlGaAsSb in the first and second interlayers is substantially identical.

19. The distributed Bragg reflector of Claim 18 wherein the semiconductor alloy composition of the AlGaAsSb in the first and second interlayers is $Al_xGa_{1-x}As_{1-y}Sb_y$ with $0.89 < x < 1.0$ and with $0.44 < y < 0.445$.

20. The distributed Bragg reflector of Claim 12 wherein the plurality of repeat units comprises at least six repeat units and less than or equal to fifty repeat units.

21. A distributed Bragg reflector for use at a wavelength near 1.55 μm comprising a plurality of alternating high-index and low-index layers, with the high-index layers comprising $Al_{0.1}Ga_{0.9}As_{0.52}Sb_{0.48}$ and with the low-index layers comprising indium phosphide (InP); and an interlayer comprising $AlAs_{0.56}Sb_{0.44}$ or $Al_xGa_{1-x}As_{1-y}Sb_y$ with $0.89 < x < 1.0$ and with $0.44 < y < 0.445$ located between each adjacent pair of the high-index and low-index layers.

22. The distributed Bragg reflector of Claim 21 wherein the interlayer has a layer thickness of less than or equal to 10 nanometers.

23. The distributed Bragg reflector of Claim 21 wherein a repeat unit comprising a pair of the high-index and low-index layers and a pair of adjacent interlayers has an optical thickness substantially equal to one-half of the wavelength near 1.55 μm.